Geology and Soils

Affected Environment

Geology

The 84-mile corridor for the proposed transmission line is within the northern boundary of the Columbia River Plateau. The Columbia River plateau is a broad rolling basalt plateau that slopes gently to the southwest and covers approximately 63,000 square miles throughout Washington, Oregon, and Idaho. Topography is gently rolling to moderately hilly with elevations generally ranging from 985 to 1,970 feet above mean sea level. Landforms found within the project corridor and vicinity include uplands covered by ***loess*** (wind-deposited sediment), channeled ***scablands***, canyons, and river terraces.

The geology of the Columbia River plateau is dominated by the Columbia River Basalt formation. This huge basalt layer, ranging in thickness from about 2,000 to over 4,900 feet was formed from vast outpouring of lavas during the Miocene epoch (28-12 million years ago) and Pliocene epoch (12-1.5 million years ago). Younger geologic deposits consisting mainly of loess deposited in the Pleistocene epoch (1.5 million to 11,000 years ago) cover the basalt over most of the corridor.

Channeled scablands are unique geologic features that are found primarily within the western half of the corridor and within scattered areas in the eastern half of the corridor. These areas consist of numerous dry, deeply cut channels in Columbia River basalt and typically contain shallow, stony soils. The channeled scablands are thought to have formed during the Pleistocene epoch when a natural dam containing glacial Lake Missoula (located in now western Montana) failed and catastrophic floods moved south across the Columbia Plateau, taking away most of the layer of loess, creating present drainages and exposing wide stretches of basalt (Franklin and Dyrness 1988).

An east-to-west trending ridge spans most of the project area, creating two separate drainages. Streams on the north side of the ridge flow to the north into the Columbia or Spokane rivers. These drainages are located in steep canyons that cross the corridor east of the City of Creston and include Spring, Welsh, Hawk, Stock, Saben, Squaw, Coulee, and Deep creeks. Drainage south of the ridge follows broad, shallow scabland channels from northeast to southwest before eventually reaching Crab Creek and the Columbia River.

Soils

Soils along the project corridor have formed primarily in loess, ***glacial outwash***, ***colluvium***, ***alluvium***, and weathered granite. Four general categories of soils occur within the corridor.

Deep Silt Loam Soils

These soils developed on rolling, loess-covered uplands. Soils are used mostly for non-irrigated cropland. Water erosion is a concern on disturbed sites with steep slopes. Figure 3-35 shows the low, medium, and high erosion potential given the slope and soil type present.

Shallow Rocky Soils

Exposed bedrock covers much of the surface within the scablands. Soils have formed in glacial sands and gravels left by the Pleistocene floods and are covered with a thin loess layer. Soils are shallow and rocky, supporting open range for cattle grazing. On the scabland plateaus, the land is broken by circular mounds of loess surrounded by basalt cobbles.

Deep Sandy Soils

These soils developed in sandy glacial outwash deposits near Bell Substation and on terraces along the Spokane and Columbia rivers and Coulee Creek. Some soils have been reworked and are shaped like dunes. Soils support open range, woodland grazing, or are used for urban development. Soils are subject to erosion when disturbed on steep slopes.

Soils in Deep Canyons

Soils in deep canyons formed in a mix of loess and colluvium from basalt or in weathered granite and overlying loess. These soils are well drained and support open range or woodland grazing. In some places, rock outcrops are over 50 feet high. Steep slopes increase the risk of erosion of these soils.

Environmental Consequences

Construction and maintenance of transmission lines can impact earth resources in many ways. Disturbance of the ground surface and subsurface, removal of vegetation during site and corridor clearing, access road widening, and structure site preparation increase the risk of soil erosion and ***mass movement***, and may change soil productivity and physical characteristics. Areas most vulnerable include soils prone to erosion, mass movement, or compaction; steep slopes; and areas where extensive access road work and clearing are required. The ***erosion susceptibility*** of soils along the corridor was used to address impacts on soils due to construction activities. Wherever practical, such problem areas are avoided.

Sediment introduced into surface waters is a concern where loess-covered upland soils and soils in steep canyons would be disturbed. Sediment yield for loess-covered upland soils is estimated at about 0.2-0.5 acre-feet/square mile/year. Sediment yields in channeled scablands are much lower, decreasing by a factor of 10 (Pacific Northwest River Basins Commission, 1970).

GRAND COULEE - BELL 500kV TRANSMISSION LINE PROJECT

SOIL EROSION SUSCEPTIBILITY

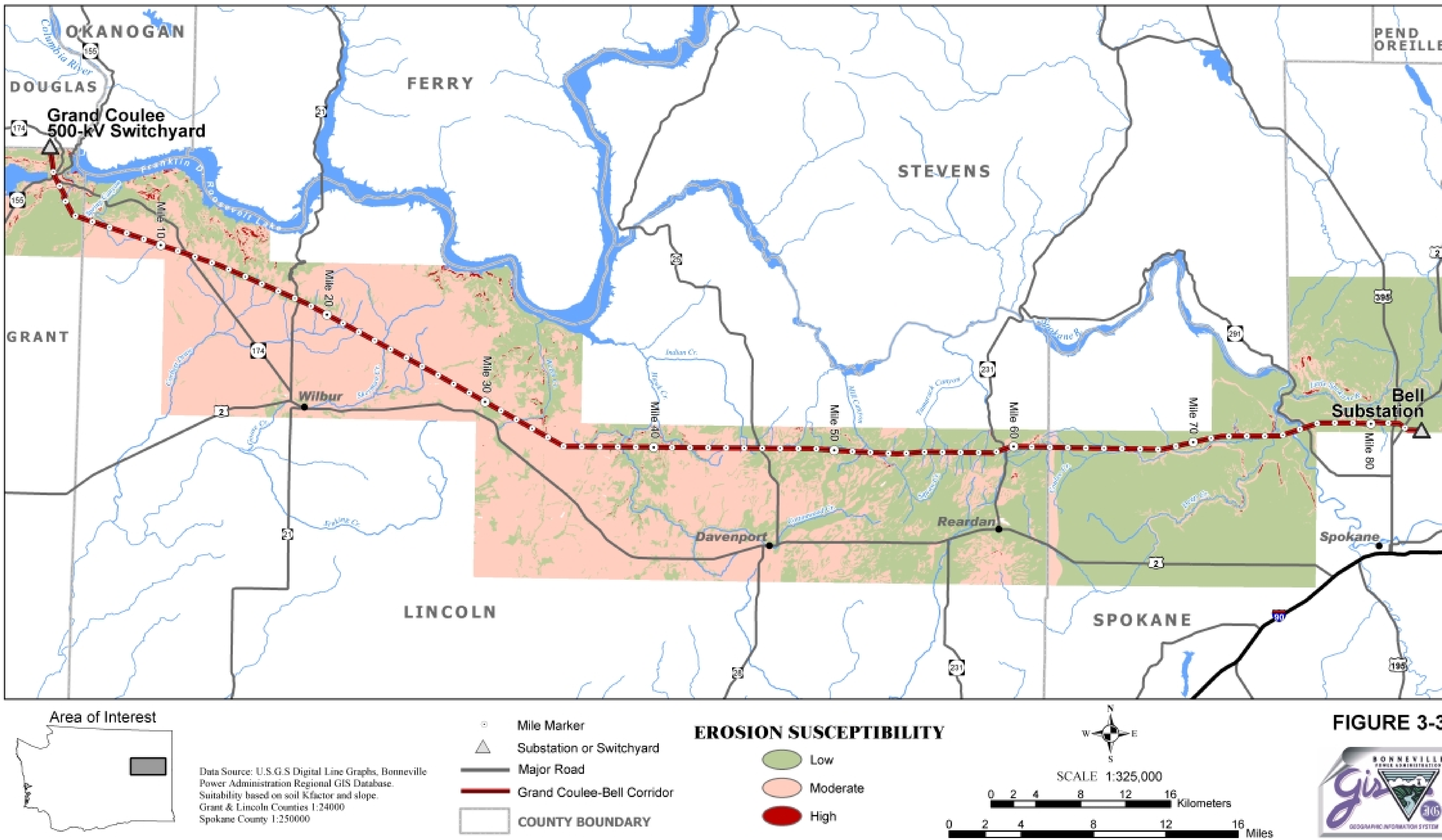

FIGURE 3-35

Most impacts would be from construction and would be short term. Impacts would be greatest during and immediately after construction until revegetation, drainage, and erosion controls are established. Long-term impacts could be caused by local changes in erosion and runoff rates from road and transmission line construction and clearing. Site restoration and mitigation would reduce both short- and long-term impacts and the effect erosion, sedimentation, and soil compaction could have on other resources such as land use, water, wetlands, vegetation, and fish.

Impact Definitions

A **high** impact would occur under the following circumstances:

- Road or facility construction and/or clearing are required on sites prone to mass movement or erosion and mitigation cannot provide full compensation.
- Soil properties or site features are so unfavorable or difficult that mitigation cannot provide full compensation.
- Project activities cause accelerated erosion, sedimentation, or slides that create long-term impacts and mitigation cannot provide full compensation.

A **moderate** impact would occur under the following circumstances:

- Road or facility construction and/or clearing takes place on soils with a moderate to high erosion potential; and mitigation could provide partial compensation.
- Soil properties and site features are such that mitigation could provide partial compensation.
- Project activities cause accelerated erosion, sedimentation, or slides that create short-term impacts and mitigation could provide partial compensation

A **low** impact would occur under the following circumstances:

- Road and facility construction and clearing takes place on soils with a low to moderate erosion hazard, mitigation could provide full compensation.
- Soil properties and site features are such that mitigation could provide full compensation.
- Project activities would not cause accelerated erosion, sedimentation, or slides that create short-term impacts and mitigation could provide full compensation.

Impacts

Towers and Related Construction

Removal of existing wooden structures would result in direct and indirect impacts to soils. Direct impacts could result from excavation, removal of vegetation or soil compaction during the access to and removal of the existing wooden structures. Typically, existing wooden structures would be excavated or cut off 2 feet below ground level and holes backfilled with native material. Typically, a 6-foot radius area would be excavated around each wood pole structure for removal. The total area disturbed for the removal of existing wood pole structures is estimated to be up to about 17 acres, with about one-half of this in soils with low erosion susceptibility. However, wood pole structures located in areas with high erosion susceptibility would be cut off at ground level. The wood poles in these locations would be dragged out or lifted out by crane to avoid bringing in construction equipment that would disturb soils. Indirect impacts could occur if vegetation was crushed to the extent that wind erosion increased. The impact level resulting from the removal of existing wooden structures would be low to moderate.

Construction areas around towers would result in direct and indirect impacts to about 210 acres of soil, with about one half in soils with low erosion susceptibility. Direct impacts would result from disturbance of soils during vegetation removal and grading. Indirect impacts would result from possible increased wind erosion.

From corridor mile 28/1 to 42/5, the corridor predominately crosses broad areas of channeled scablands, which are nearly level with rocky, shallow soils. These impacts would be low, except where the corridor crosses several important drainages. Areas of concern are the Welsh Creek drainage (corridor mile 32/8 to 32/9) and the deeply incised canyons of Hawk (38/8 to 39/5) and Stock (42/4 to 43/4) creeks. A combination of steep slopes, moderately to highly erosive soils, and clearing requirements near these areas could cause short-term increased runoff and erosion. The impact level would be moderate from construction areas near Welsh, Hawk, and Stock creeks.

The corridor crosses Saben and Squaw creeks between corridor mile 52/1 and 54/7. Slopes exceed 30 percent and are covered by talus from basalt cliffs at the top of the canyons. Construction areas could cause short-term increased runoff and erosion. The impact level would be moderate from construction areas near Saben and Squaw creeks.

Much of the corridor from corridor mile 66/4 to near Springhill Substation (corridor mile 74/5) is on relatively level, shallow, rocky scabland soils. Impacts would be low along most of this section. However, soils with moderate to high erosion potential on the side-slopes above Coulee Creek (corridor mile 72/1 to 74/1) could cause short-term increased runoff and erosion. In these areas impacts would be moderate, with soil disturbance from construction activities increasing runoff and temporary erosion rates.

From corridor mile 74/1 to Bell Substation concern for impacts would be low except where clearing is needed on slopes exceeding 15 percent. Potential for clearing on sensitive areas include: in the Coulee Creek – Deep Creek area (corridor mile 75/7 to 76/1); near the Spokane River crossing (corridor mile 75/7 to 76/7); and below Burnett Road (corridor mile 80/3 to 80/6). Clearing would increase runoff and erosion. The impacts level would be moderate due to construction areas in these areas.

Construction of new towers would result in direct and indirect impacts to 24 acres of soils, with about one half in soils with low erosion susceptibility. Direct impacts would result from disturbance of soils during vegetation removal and grading. Indirect impacts would result from possible increased wind erosion. Towers would not be placed on steep slopes and related high erosion susceptible soils; therefore, the impact level would be low to moderate for construction of new towers.

Conductor tensioning sites and staging areas would result in direct and indirect impacts to 42 acres of soils, with about one half in soils with low erosion susceptibility. Heavy equipment and increased vehicular traffic during construction and line removal may compact soils, thereby affecting soil productivity, reducing infiltration capacity, and increasing runoff and erosion. It is expected that ***subsoiling***, normal farming, cultivation, cropping, and freeze-thaw cycles would restore the soil to its pre-construction conditions (Moe, et al., 1971). Impacts to soils at conductor tensioning sites and staging areas in these areas are expected to be low to moderate.

Road Construction

Construction of new access roads would have direct and indirect impacts to 15.6 acres of soils as a result in construction of approximately 8 miles of new access roads. Direct impacts would result from soil disturbance during excavation and grading. Indirect impacts would result from vegetation removal increasing erosion. New access roads would be created in locations where the existing access roads pass beneath transmission line towers that do not provide adequate clearance for tower construction vehicles. Access roads would also be relocated in a few sites where the new proposed tower locations are within, or close to, the existing access roads. In some locations, sections of access road would be constructed to ensure that the road remained within the corridor. No permanent roads would be constructed in cultivated areas. Only temporary access on farmlands is needed. Impacts would be low and short term, causing temporary local increases in erosion and sedimentation during, and for a brief time after, construction. Construction of new access roads would likely avoid areas of high erosion susceptibility. Therefore, the impact level would be low to moderate from construction of new access roads.

Construction of temporary spur roads would have direct and indirect impacts to 12.6 acres of soil as a result in construction of approximately 6.3 miles of spur roads. Direct impacts would result from soil disturbance during excavation, and grading. Indirect impacts would result from vegetation removal increasing erosion. Construction of new access roads would likely avoid areas of high erosion susceptibility. Therefore, the impact level would be low to moderate from construction of new access roads.

Improvements to existing access roads would have direct and indirect impacts to 52.5 acres of soils as a result in improvements to about 27 miles of existing roads. Direct impacts would result from soil disturbance during excavation, and grading. Indirect impacts would result from vegetation removal increasing erosion. In order to provide for safe passage of cranes, excavators, supply trucks, boom trucks, log trucks, and line trucks needed for construction and maintenance of the transmission line, some portions of existing access roads would be improved by grading, improving drainage, and adding gravel to the road surface.

The corridor from the Grand Coulee Switchyard to Spring Creek Canyon (corridor mile 6/2) has shallow, rocky soils and rock outcrops. No ground disturbance would occur on the steep canyon walls and cliffs above Grand Coulee. Since most disturbances would be limited to level or gently sloping scabland areas, impacts would be low and would cause slight increases in runoff, erosion, and small quantities of sediment moved off site. The impact level resulting from existing road improvements in this area would be low.

Uncultivated land with shallow, rocky soils occurs between corridor mile 13/6 and 19/3. Slopes tend to be less than 15 percent and soils have a low to moderate erosion susceptibility. Existing roads would be upgraded. Increased erosion and off-site movement of sediment would be greatest during and shortly after construction. The impact level would be low to moderate due to existing road improvements in this area.

The corridor crosses Saben and Squaw creeks, tributaries to Mill Creek, between corridor mile 52/1 and 54/7. Granite outcrops are exposed in access road cuts within Squaw Canyon. Soils have a moderate to high erosion susceptibility. The impact level resulting from existing road improvements in this area would be moderate to high.

Much of the corridor from corridor mile 66/4 to near Springhill Substation (corridor mile 74/5) is on nearly level, shallow, rocky scabland soils. The potential for impacts would be low along most of this section. There is concern about impacts where access road widening would occur on soils with moderate to high erosion susceptibility on the side-slopes above Coulee Creek (corridor mile 72/1 to 74/1). The impact level resulting from existing road improvements in this area would be moderate.

From corridor mile 74/1 to Bell Substation the corridor crosses excessively drained, deep sandy and gravelly soils formed in glacial outwash. Except on steep slopes, these soils have a low susceptibility to erosion by water and the potential for impacts would be low. The potential for impacts would be moderate where access improvements are needed on slopes exceeding 15 percent. Potential wind erosion attributable to construction-related disturbance of soils would need to be reduced through revegetation. Areas potentially more sensitive to impacts include the Coulee Creek - Deep Creek area (corridor mile 75/7 to 76/1) and the area near the Spokane River crossing (corridor mile 75/7 to 76/7). The impact level would be moderate to high due to existing road improvements in these areas.

Installing/replacing culverts would have direct and indirect impacts to soils. Direct impacts would result from increased erosion due to soil disturbance. Indirect impacts would result from increased erosion due to vegetation removal. Seventeen new culverts and nine replacement culverts would be installed in areas with low to moderate soils susceptibility. Therefore, the impact level would be low to moderate due to the installation of culverts.

Operation and Maintenance

Operation of the new transmission line would not have direct and indirect impacts to soils.

Maintenance of the new transmission line would have direct and indirect impacts to soils. Direct impacts would result from localized soil disturbance and potential sedimentation due to vehicular traffic, transmission structure replacement, and access road improvements. Indirect impacts would result from increased erosion due to vegetation management activities. Anticipated erosion rates during operation and maintenance are expected to remain at or near current levels, once revegetation has occurred. Landowners would be compensated for any maintenance-related soil impacts as they would be for construction-related impacts.

Environmental Consequences of the Alternative Action

Geology and soil impacts would be the same for the alternative action.

Cumulative Impacts

Agricultural practices can be a major contributor to soil erosion and increased sedimentation of streams. On slopes over 7 percent, it is estimated that cultivated soils have lost over 6 inches of topsoil over a 90-year period (U.S. Department of Agriculture, Soil Conservation Service, October 1981). The U.S. Department of Agriculture's Conservation Compliance Program for Highly Erodible Land was instituted to promote soil conservation practices among farm operators. Interference with existing or planned conservation measures could result in increased or continued erosion and subsequent sedimentation. Where practical, new transmission towers would be aligned with existing steel towers, thus interference with farm conservation efforts is not expected and may be benefited compared to existing conditions.

Only minor, localized increases in erosion, runoff, and sedimentation may occur from the proposed action. It is expected that these increases would contribute minimally to the area's ongoing soil loss and sedimentation of drainages.

Mitigation

Any potential impacts to soils would be minimized by the installation of runoff and erosion controls and would be further diminished following revegetation.

An environmental specialist would visit the site with construction personnel to decide which mitigation approaches are best suited to individual locations to reduce erosion and runoff, and to stabilize disturbed areas. The specific location and type of mitigation would be determined when road and line designs are finalized. The following standard mitigation measures would minimize impacts:

- Properly spaced and sized culverts, cross-drains, and water bars will be used. Contractors will armor ditches and drain inlets and outlets where needed for erosion control.
- Avoid construction on steep, unstable slopes if possible.
- All excavated material not reused would be deposited in an upland area and stabilized. No used material would be deposited in environmentally sensitive areas such as streams, riparian areas, wetlands, or floodplains.
- Apply erosion control measures such as silt fence, straw mulch, straw wattles, straw bale check dams, other soil stabilizers, and reseeding disturbed areas as required (prepare a Stormwater Pollution Prevention Plan).
- Regularly inspect and maintain project facilities, including the access roads, to ensure erosion levels remain the same or less than current conditions.
- Where agricultural and rangeland soils are compacted, assistance would be provided to farmers and ranchers for subsoiling to restore soil productivity.

Environmental Consequences of the No Action Alternative

Current levels of disturbance to soils and geology associated with ongoing maintenance activities for the existing transmission line, substations, and right-of-way would continue under the No Action Alternative. This would include localized soil disturbance, potential erosion, and soil compaction due to vehicular traffic, transmission structure replacement, vegetation management activities, and access road improvements. No new impacts to soils and geology are expected under this alternative.